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IS 8560 (1977): Aluminium clad aluminium alloy sheet and strip for aircraft purposes (Alloy 24530) [MTD 7: Light Metals and their Alloys]



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SPECIFICATION FOR ALUMINIUM CLAD ALUMINIUM ALLOY SHEET AND STRIP FOR AIRCRAFT PURPOSES (ALLOY 24530)

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SPECIFICATION FOR ALUMINIUM CLAD ALUMINIUM ALLOY SHEET AND STRIP FOR AIRCRAFT PURPOSES (ALLOY 24530)

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Indian Standard

SPECIFICATION FOR ALUMINIUM CLAD ALUMINIUM ALLOY SHEET AND STRIP FOR AIRCRAFT PURPOSES (ALLOY 24530)

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 19 August 1977, after the draft finalized by the Light Metals and Their Alloys Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 Aluminium coated Al-Cu-Mg-Si-Mn aluminium alloy sheet products conforming to IS : 3436-1967* are extensively used for fabrication of aircraft structural components, but aluminium coated Al-Cu-Mg-Mn alloy sheet products are also used for critical components/skins by virtue of its superior fatigue resistance property. This standard has been prepared to cover the requirements for aluminium coated Al-Cu-Mg-Mn sheets.

0.3 Various international standards have been given due weightage in the formulation of this standard in addition to relating it to the practices prevailing in this field in the country. This has been done by deriving assistance from the following publications:

- BS L109:1971 Aluminium-coated sheet and strip of aluminium-copper-magnesium-manganese alloy (solution treated and aged at room temperature). British Standards Institution.

BS L110:1971 Aluminium-coated sheet and strip of aluminium-copper-magnesium alloy (supplied for solution treatment by the user). British Standards Institution.

QQ-A-250/5F-1971 Aluminium alloy alclad 2024, plate and sheet. US Federal Specification.

GOST 12592-1967 Aluminium and aluminium alloy structural sheets. Komitet Standartov, Mer i Izmeritelnyh Priborov pri Sovete Ministrov USSR.

*Specification for aluminium-clad aluminium alloy sheet, strip and coil for aircraft purposes.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard covers the requirements of aluminium coated aluminium-copper-magnesium-manganese alloy sheets, strips and coils for aeronautical applications.

2. MATERIAL

2.1 The sheet, strip and coil shall consist of a core of the alloy specified in 5.1, clad uniformly on both sides with aluminium, having the chemical composition specified in 5.2. Unless otherwise agreed to, the minimum average thickness of cladding on each side shall be not less than 4 percent of the total sheet thickness for products up to and including 1.6 mm thick and shall be not less than 2 percent for thicker sheets.

3. INSPECTION AND TESTING PROCEDURE

3.1 This standard shall be used in conjunction with IS : 3420-1976†.

4. FREEDOM FROM DEFECTS

4.1 Alloy sheets, strips and coils shall have clean, uniform, smooth, flat surfaces and shall be free from harmful defects, such as blisters, laminations, buckles, deep scratches and discolouration in patches (however, discolouration due to heat treatment shall not be a cause for rejection). Any sheet, strip and coil may be rejected for manufacturing defects, notwithstanding its conformity to chemical composition and mechanical properties.

5. CHEMICAL COMPOSITION

5.1 The chemical composition of each cast of the alloy comprising the core of the sheet, strip and coil, when analysed in accordance with IS : 504-1963‡ shall be as given in Table 1.

*Rules for rounding off numerical values (*revised*).

†Procedure for inspection and testing of aluminium and aluminium alloy, sheets and strips for aircraft purposes (*first revision*).

‡Methods of chemical analysis of aluminium and its alloys (*revised*).

TABLE 1 CHEMICAL COMPOSITION

(Clause 5.1)

ELEMENT	PERCENT
Copper	3.8-4.9
Magnesium	1.2-1.8
Manganese	0.3-0.9
Silicon	0.50 <i>Max</i>
Iron	0.50 <i>Max</i>
*Nickel	0.05 <i>Max</i>
*Zinc	0.2 <i>Max</i>
*Lead	0.05 <i>Max</i>
*Tin	0.05 <i>Max</i>
*Titanium + Zirconium	0.2 <i>Max</i>
*Chromium	0.10 <i>Max</i>
Aluminium	Remainder

*Subject to the discretion of the Inspecting Authority, determination of these elements need be made on a small proportion only of the samples analysed.

5.1.1 For the making of the core material, aluminium complying with IS : 23-1965* and the alloying constituents with or without approved scrap shall be used at the discretion of the manufacturer.

5.2 The chemical composition of the cladding when analysed in accordance with IS : 504-1963† shall be as follows:

<i>Elements</i>	<i>Percent</i>
‡Aluminium	99.5 <i>Min</i>
Copper	0.03 <i>Max</i>
Silicon	0.30 <i>Max</i>
Iron	0.40 <i>Max</i>
Zinc	0.05 <i>Max</i>
Manganese	0.03 <i>Max</i>

*Primary (virgin) aluminium notched bars and ingots for remelting for aircraft purposes.

†Methods of chemical analysis of aluminium and its alloys (*revised*).

‡To be determined by difference.

6. CONDITION

6.1 Sheets, strips and coils shall be supplied in any of the following conditions:

Type I Annealed condition

Type II Solution treated, straightened and naturally aged.

Type III Any other condition as agreed to between the manufacturer and the purchaser. The condition in which the material is to be supplied shall be stated by the purchaser on the order.

NOTE — Straightening/flattening operation subsequent to quenching may produce an effective reduction of a minimum of one percent of thickness.

7. HEAT TREATMENT

7.1 The material shall be heat treated as follows:

Type II

- a) Solution treat by heating at a temperature of $495 \pm 5^{\circ}\text{C}$ and quench in water at a temperature not exceeding 40°C .
- b) Age at room temperature for not less than 48 hours.

Type III As specified by the purchaser.

NOTE 1 — Not more than two re-solution treatments shall be carried out on any sheet/component.

NOTE 2 — Soaking time shall be as short as permissible to avoid excessive diffusion from the alloy core into the aluminium cladding. For maximum resistance to corrosion, the quench delay shall be minimum and quenching water cold.

NOTE 3 — Straightening flattening operation shall be accomplished after quenching and before ageing.

8. MECHANICAL PROPERTIES

8.1 The mechanical properties obtained from test pieces selected and prepared in accordance with IS : 3420-1976* and tested in accordance with IS : 1816-1961† shall not be less than the values given in Tables 2 and 3.

*Procedure for inspection and testing of aluminium and aluminium alloy sheets and strips for aircraft purposes (*first revision*).

†Method for tensile test for light metals and their alloys.

TABLE 2 MECHANICAL PROPERTIES

(Clause 8.1)				
TYPE	NOMINAL THICKNESS mm	0.2 PERCENT PROOF STRESS MPa (kgf/mm ²)	TENSILE STRENGTH MPa (kgf/mm ²)	ELONGATION ON GAUGE LENGTH OF 50 mm, PERCENT
(1)	(2)	(3)	(4)	(5)
I	0.4 up to and including 0.8	—	225 (23)	10
	Over 0.8 up to and including 1.6	—	225 (23)	10
	Over 1.6 up to and including 6.0	—	235 (24)	10
II	0.4 up to and including 0.8	270 (27.5)	405 (41.5)	12
	Over 0.8 up to and including 1.6	270 (27.5)	405 (41.5)	15
	Over 1.6 up to and including 6.0	275 (28.0)	425 (43.5)	15
III	As specified by the purchaser			

TABLE 3 MECHANICAL PROPERTIES OF MATERIAL HEAT-TREATED BY THE USER

(Clause 8.1)				
	NOMINAL THICKNESS mm	0.2 PERCENT PROOF STRESS MPa (kgf/mm ²)	TENSILE STRENGTH MPa (kgf/mm ²)	ELONGATION ON GAUGE LENGTH OF 50 mm, PERCENT
	(1)	(2)	(3)	(4)
	0.4 up to and including 0.8	255 (26.0)	390 (40.0)	12
	Over 0.8 up to and including 1.6	255 (26.0)	390 (40.0)	15
	Over 1.6 up to and including 6.0	265 (27.0)	410 (42.0)	15

9. SPECIAL TESTS

9.1 Drip Test

9.1.1 For checking effectiveness of cladding, drip test shall be carried out on a sample of sheet by applying droplets of sodium hydroxide solution (10 g in 100 ml distilled water) or HF solution (4 percent hydrofluoric acid in water) on the clad surface for 10 minutes. If it produces a blackish stain, it indicates insufficient cladding thickness or excessive diffusion of copper into the cladding in which case it shall be determined metallographically on mounted specimen (a minimum of 5 readings on each side) of at least 3 sheet samples.

9.2 Ultrasonic Inspection — Subject to agreement between the manufacturer and the supplier, sheet material above 3 mm in thickness may be ultrasonically checked for internal defects.

10. TOLERANCES ON DIMENSIONS

10.1 Tolerance on dimensions of sheet, strip and coil shall be given in IS : 3420-1976*.

11. IDENTIFICATION

11.1 Each sheet and each coil approved by the inspector shall be stamped with the mark of the inspector and such other markings as shall ensure full identification of the material.

11.2 Unless otherwise agreed to, one side of each sheet approved by the inspector shall be marked/stencilled all over at intervals of 250 mm, with the specification number, type of material, condition and the manufacturer's identification symbol.

11.3 One side of each coil or strip that is not less than 50 mm wide and is not less than 0.5 mm thick, approved by the inspector shall be marked/stencilled all over with the specification number, type of material, condition and the manufacturer's identification symbol.

12. CERTIFICATION

12.1 All supplies shall be accompanied by certificates for freedom from defects, chemical composition of the core alloy and the cladding material, heat treatment and mechanical properties as laid down in 4, 5, 7 and 8 respectively or as required by the Inspecting Authority.

12.2 The manufacturer shall, when required, supply free of charge, a copy of the works' analysis of the material. Works analysis is defined as the routine analysis conducted by the manufacturer in order to control the quality of the material.

13. CORROSION PREVENTION

13.1 The identified sheets and coils of strips shall be coated with suitable temporary protective coating with or without interleaving non-corrosive paper (oil paper, etc) before transit or storage.

*Procedure for inspection and testing of aluminium and aluminium alloy, sheets and strips for aircraft purposes (*first revision*).

14. PACKING

14.1 Unless otherwise specified, the sheets and strips shall be oiled/greased and packed with interleaving paper to avoid any chafing. Grease and paper shall be neutral and non-corrosive. The whole package shall be wrapped in strong waterproof paper in such a way as to avoid ingress of moisture, dust, etc, and shall be placed in a box or crate with a view to prevent any displacement of sheet metal. Gluing of sheet surfaces with neutral sticky paper in places is also permissible to prevent chafing in place of interleaving paper.

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